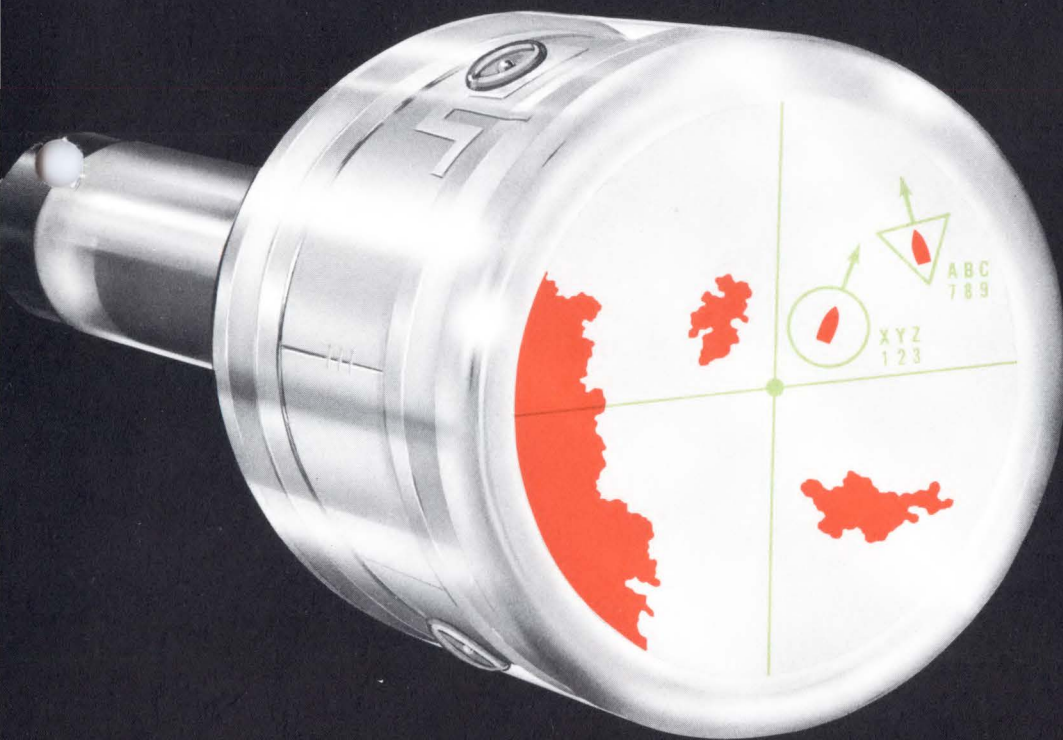


# RCA STORAGE TUBES

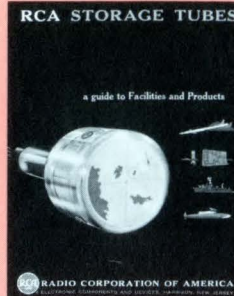
a guide to Facilities and Products



**RADIO CORPORATION OF AMERICA**

ELECTRONIC COMPONENTS AND DEVICES, HARRISON, NEW JERSEY





#### OUR COVER

... Illustrated is an outstanding example of developmental achievement in the display-storage-tube field.

When available, the C74376 promises to increase interest in the display of stored information.

## An Introduction... to RCA Storage-Tubes

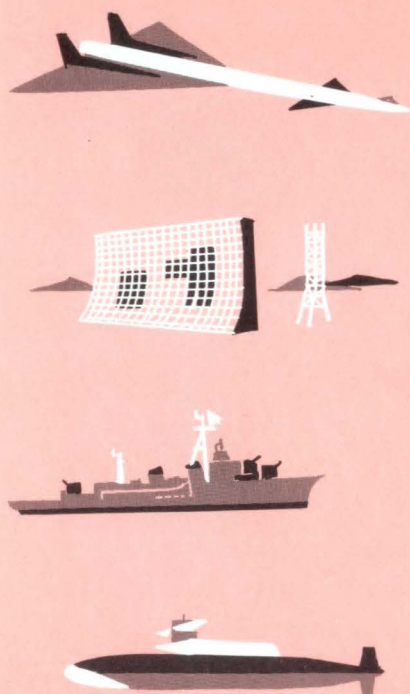
This booklet will introduce the designer of display and other information systems to RCA's Storage-Tube line and Lancaster, Pa., plant facilities. Selected examples of the RCA Storage-Tube line are included to show the broad range of physical and electrical characteristics now available. Where necessary, most of the tubes described can be readily modified to meet specific customer requirements.

A specification form is found on page 17 to assist you in defining the display-storage-tube characteristics required for your application. Our design, application, and field engineers will be glad to discuss your equipment-design needs to assure proper type selection or to initiate the design of new storage-tube types.

For technical data on commercially available RCA Storage Tubes, write Commercial Engineering, RCA Electronic Components and Devices, Harrison, N. J. For the latest technical information on developmental types, write Marketing Manager, Storage-Tube Products, RCA, Lancaster, Pa.

Please mention the specific type in which you are interested.

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.

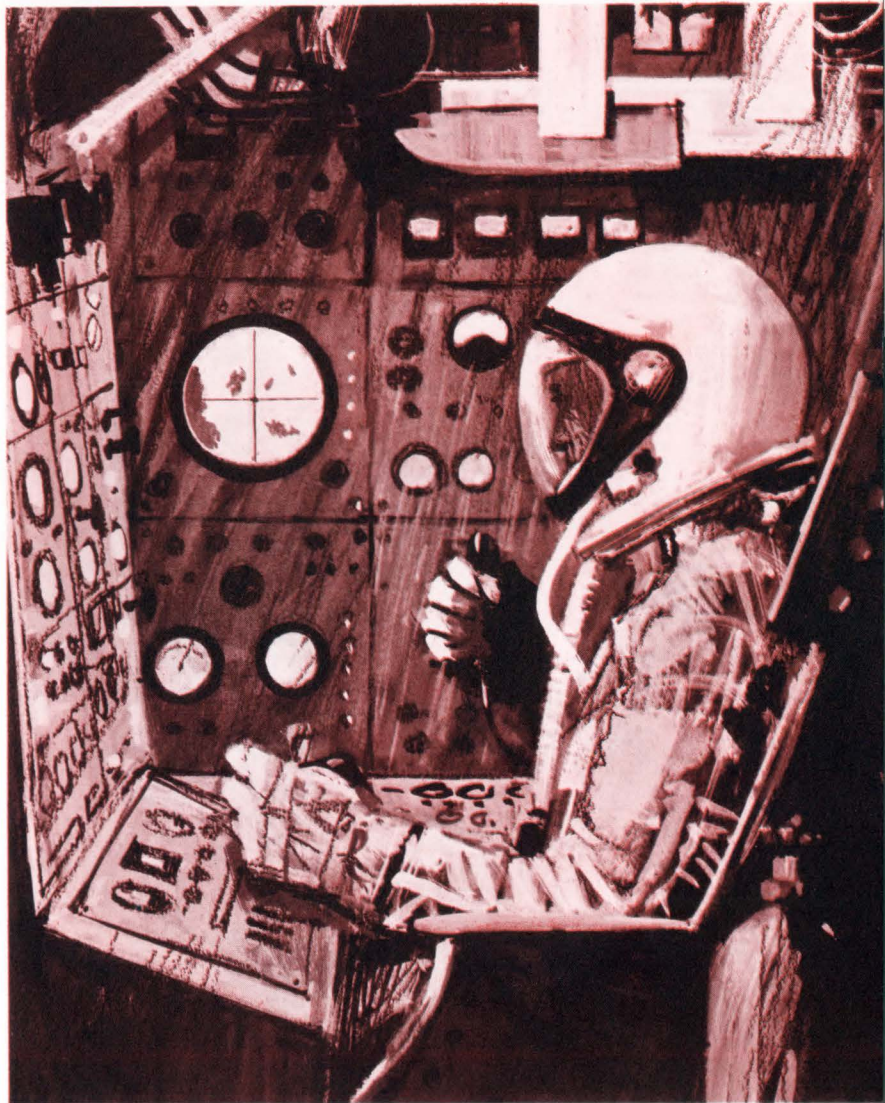




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## FACILITIES — CAPABILITY — EXPERIENCE



Mount assembly fabrication

Focal point of RCA Storage-Tube production is the Lancaster plant's "white room" where all storage-tube parts are processed and the tubes are assembled. In this area-within-an-area, cleanliness and controlled environment are of paramount importance. The "white room" is double pressure-sealed as well as air-conditioned to minimize changes in temperature, pressure, and humidity, and air-filtered to virtually eliminate dust. Only under controlled conditions as rigid as these can dependable storage tubes be produced. Although most visitors to the Lancaster plant are restricted from this area, you are invited to enter the "white room" through these pages and follow some of the steps involved in the manufacture of an RCA Display-Storage Tube.

Display-storage-tube construction begins with the fabrication of the mount assembly and the preparation of the tube envelope in areas outside of the "white room."

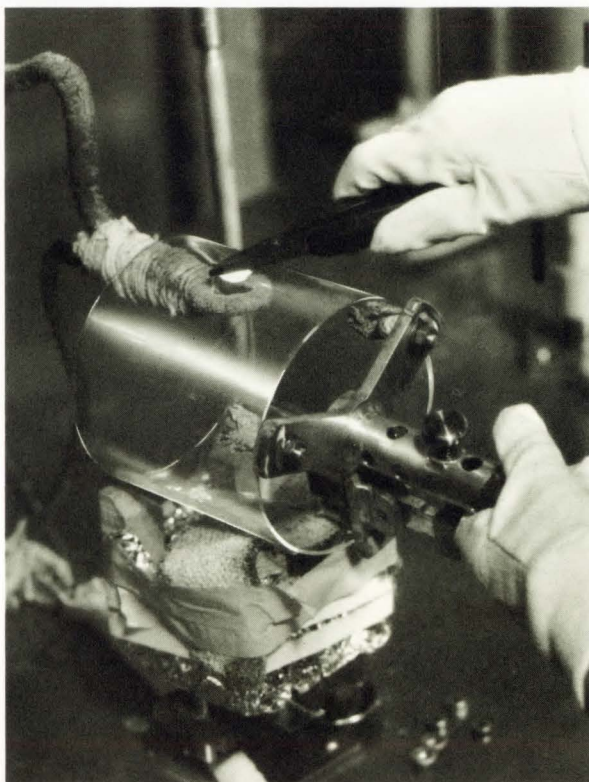
Skilled operators are shown spot welding electron-gun electrodes to the leads of a glass stem which forms the base of the mount assembly used in a display-storage tube. The gun electrodes are accurately spaced, aligned, and checked with precision instruments. The use of glass-bead construction insures that this precision spacing and alignment will be maintained throughout tube life. Before entering the "white room," the mount assembly is thoroughly cleaned.

## Spotlight RCA Storage-Tube Manufacture

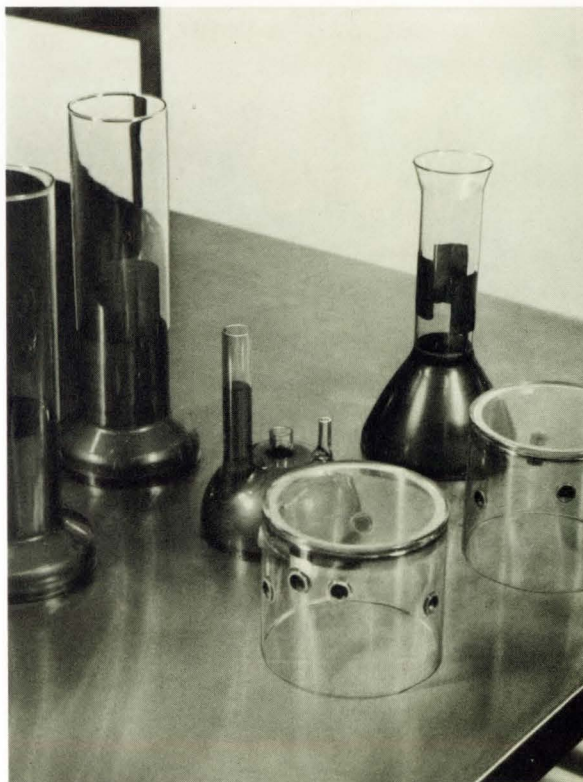
Simultaneously, the glass envelope is prepared. Cavity caps are shown being inserted into the glass cylinder, a part of the tube envelope. RF-heating techniques and craftsmanship combine to assure the annealing of perfect seals. Only optical-quality faceplates are sealed to the cylinders and individual matching of the target-

mesh assembly and the cylinder are required steps in storage-tube quality control.

Meanwhile, the glass funnel receives an internal conductive coating which becomes one of the collimating electrodes of the finished tube. Finished cylinders and coated funnels are shown in the illustration.



Glass cylinder preparation



Glass cylinders and funnels



## ...Fabrication

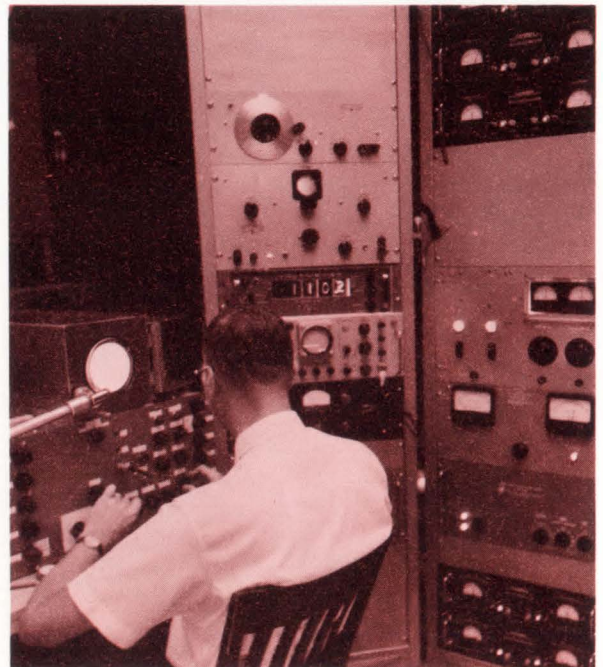
The mount assembly and envelope parts are then channeled to the "white room." A phosphor screen is applied to the faceplate, and then aluminized. The illustration shows the critical positioning of the target-mesh assembly in the glass cylinder. The funnel is then sealed to the cylinder. To reveal possible strain, glass seals are checked at all production stages by polarized light. After evacuation to a pressure of approximately  $10^{-8}$  mm of Hg, the tube is

sealed off. Far from a finished product, the tube must face numerous tests before it can qualify as an RCA Display-Storage Tube.

Now a comprehensive series of tests begin with the initial evaluation of the tube. Measurement of each rating and performance characteristic specified for the tube type is performed in this test set. If the tube has a "potted" magnetic shield, it is completely re-tested after the shield is attached.



Insertion of target-mesh assembly in the glass cylinder



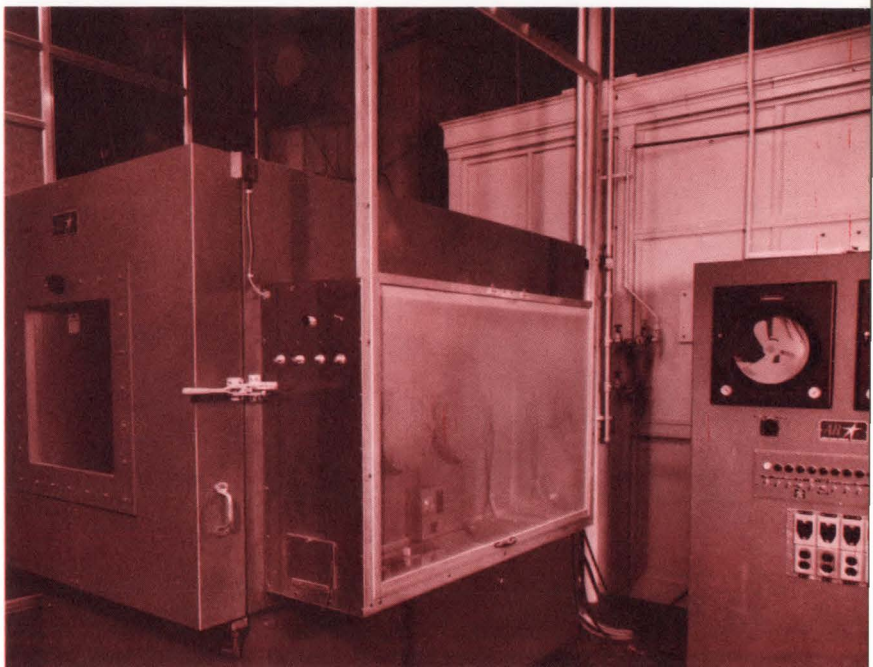
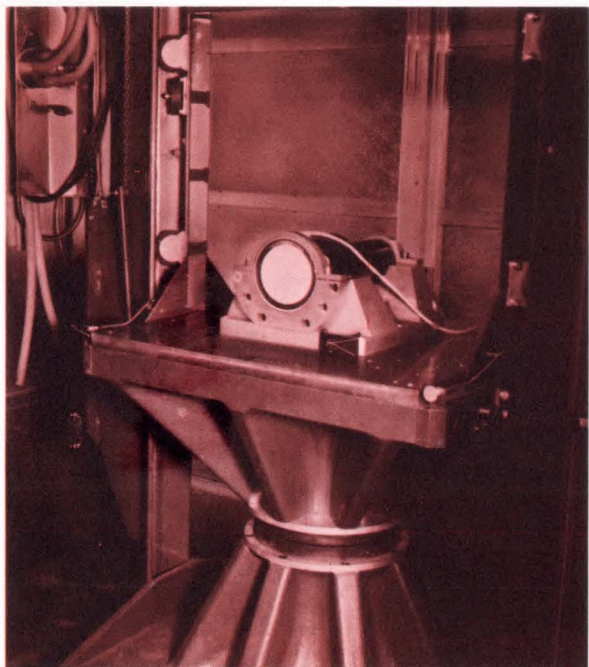
Initial tube evaluation



## ...Environmental Testing

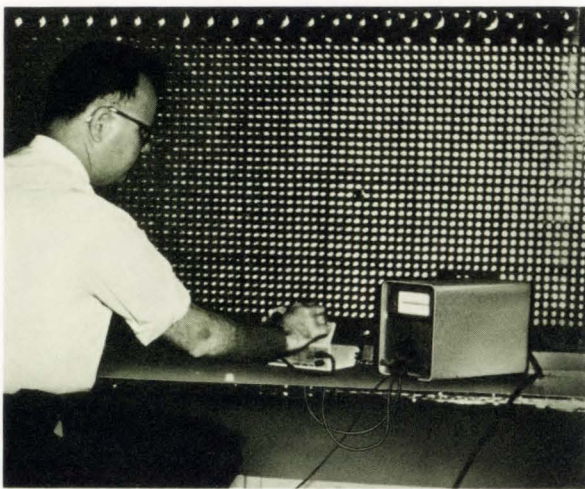
Most RCA Display-Storage Tubes also undergo environmental tests: vibration, shock, extremes in temperature and humidity, and high and low pressure. These views of RCA's environmental testing laboratory show some of the equipment used for these tests.

Quality, reliability, and environmental tests—24 hours a day, 7 days a week—continuous and exacting—assure the dependability of RCA Storage Tubes.

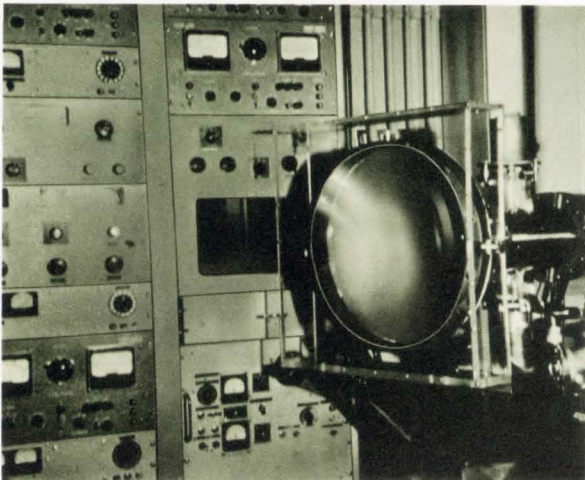


Environmental Test Laboratory Equipment

## ...And Depth in Advanced Development



RCA's Resistance Network Analog



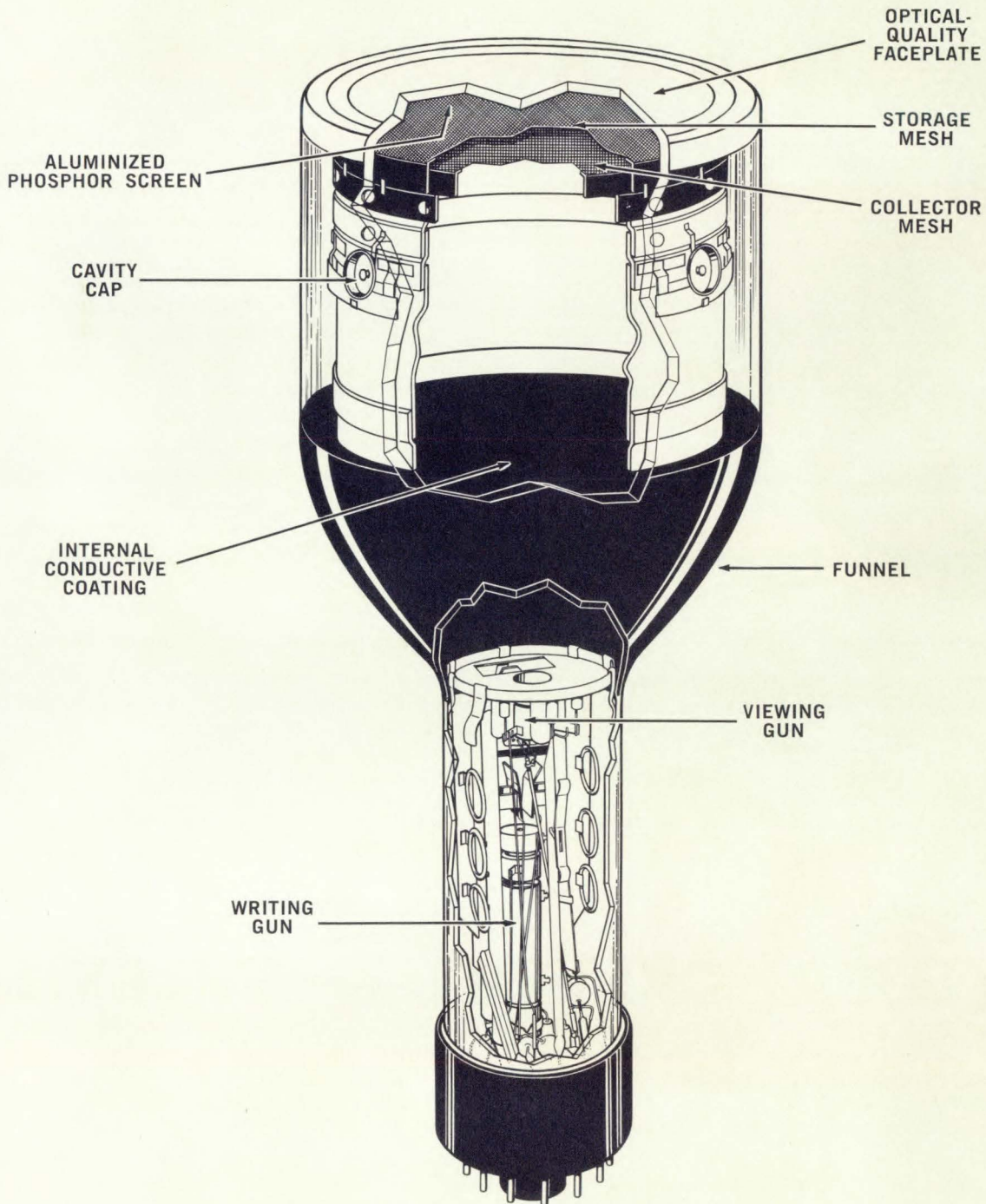
Demountable Vacuum System

Your tour of RCA-Lancaster's production facilities is not complete without a brief look at the Advanced Development area. Here, tube design of the future as well as modifications in existing tube designs are evaluated. RCA's Resistance Network Analog, a unit made up of thousands of resistors, has superseded fluid-mapping and rubber-dam techniques in beam-trajectory and field studies. Digital-computer and data-reduction facilities are also employed to analyze and solve intricate storage-tube design problems.

The evaluation of new phosphors, insulators, semiconductors, and new electrode configurations is a continuous project. Shown is a demountable vacuum system and associated equipment used in these studies. From experiments in this system, a new generation of storage tubes may evolve. RCA's Advanced Development task force draws freely on the knowledge and experience of RCA-Lancaster's Chemical and Physical Laboratory, as well as that of RCA's David Sarnoff Research Center in Princeton, N. J.

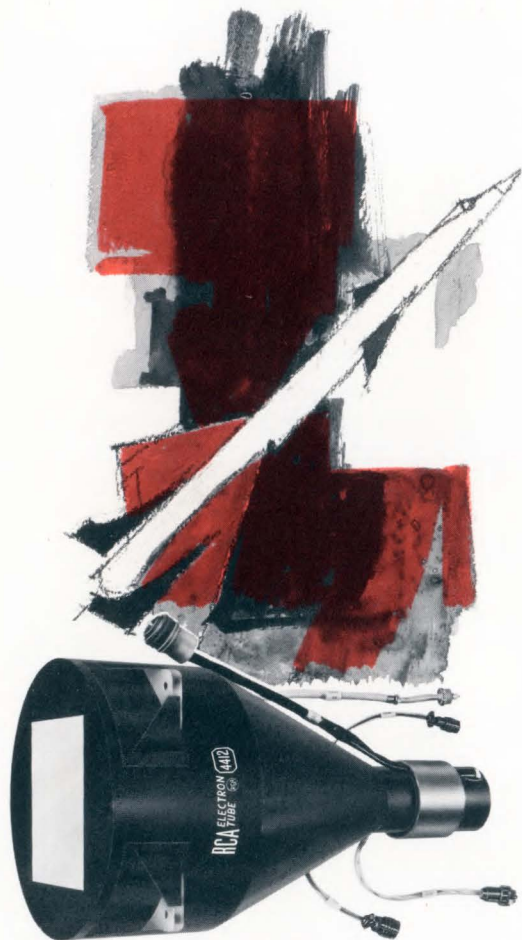


A cutaway view of a typical display-storage tube reveals many of the precision parts required in display-storage-tube manufacture.





# RCA Display-Storage Tubes

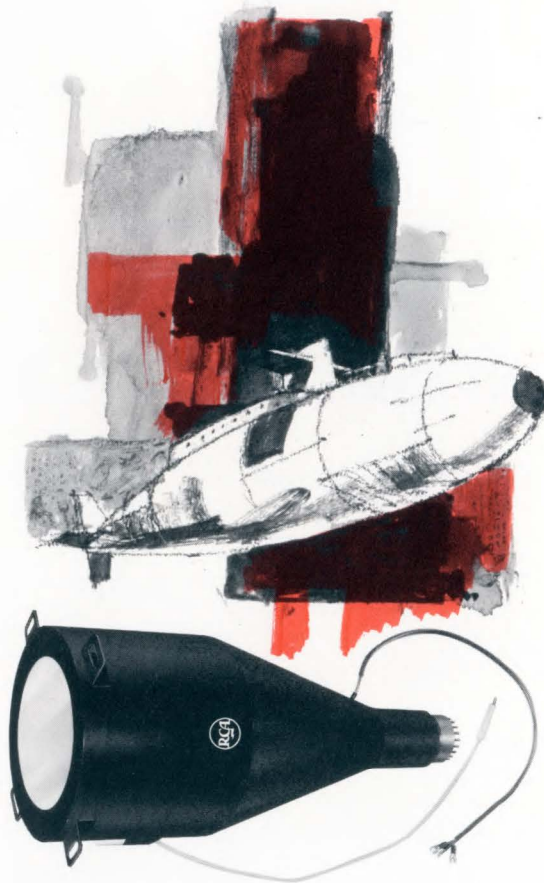


## 10"-DIAMETER DISPLAY-STORAGE TUBES

**RCA-4412**—The ability to store information for many seconds while continuously presenting it in a large non-flickering display makes the 4412 a highly recommended tube for special electronic display systems. The range of possible applications in which the 4412 may be used is extended to the most sophisticated military-airborne equipment by an extremely rugged tube structure. The ruggedized 4412 is designed to withstand conditions of shock, vibration, high humidity, high altitude, and extremes in temperature.

Features of the 4412 include:

- High display brightness which permits viewing under normal room lighting levels.
- Adjustable rate of information erasure.
- Large 5.6" x 6.4" rectangular display area.
- Rugged structure permitting use under severe environmental conditions.
- Integral magnetic shield.
- "Potted" semiflexible leads with attached connector assemblies.



## 7"-DIAMETER DISPLAY-STORAGE TUBES

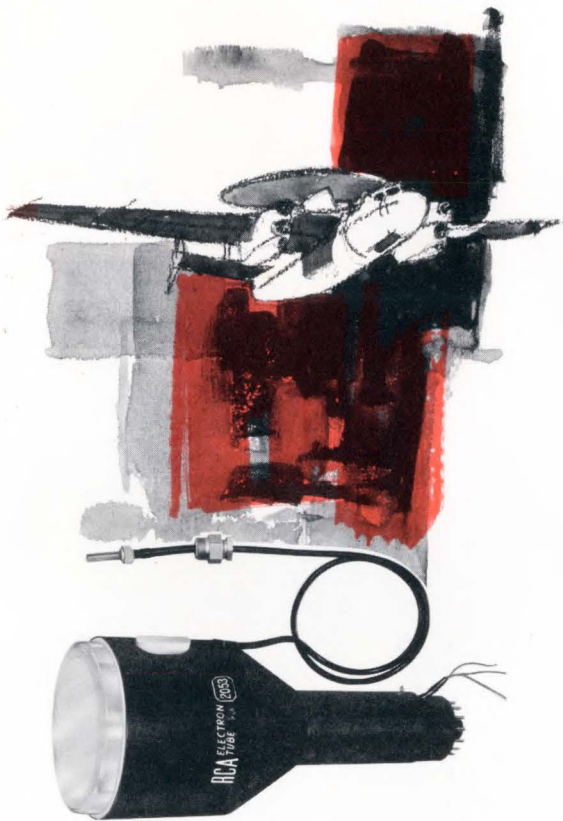
**RCA-Developmental Type C73983**—The ability to store information for many seconds at initial brightness levels makes the C73983 highly suitable for use in display systems employing very slow scanning speeds such as long-range radar, slow-scan TV, and sonar. A selective erasing feature permits the displayed information to be retained at full brightness until it is to be replaced by new information. The C73983 provides a 5¼"-diameter display having sufficient brightness to permit viewing in well-lighted areas.

Features of the C73983 include:

- Selective erasure.
- Writing gun designed for slow-speed scanning.\*
- Integral magnetic shield.
- Full 5¼"-diameter display.
- White display color (P4 phosphor screen).
- Filterglass faceplate for increased contrast.

\*Scanning speed: slow—300 to 10,000 in./sec; medium—10,000 to 50,000 in./sec; fast—50,000 to 300,000 in./sec.





### 5"-DIAMETER DISPLAY-STORAGE TUBES

**RCA-2053**—Extremely high brightness permitting daylight viewing, the ability to write information at the fast scanning speeds required for 1-mile range radar, and rugged structure make the 2053 suitable for a variety of military airborne applications such as terrain clearance, fire control, and instrumentation displays. Recommended as a good general-purpose tube, the 2053 combines compact size (a 5½"-diameter bulb, 13½"-overall length, and a 2½"-diameter neck) with moderate cost and versatility in performance. Type has served as the starting point in the design of many developmental types including the C74393, C74381, and C74410.

Features of the 2053 include:

- High brightness for daylight viewing.
- Compact size.
- Writing gun designed for high-speed scanning.\*
- Integral magnetic shield.
- Ruggedized structure permitting use under severe environmental conditions.
- Adjustable rate of information erasure.
- Integration of signals in presence of noise.



### 5"-DIAMETER DISPLAY-STORAGE TUBES

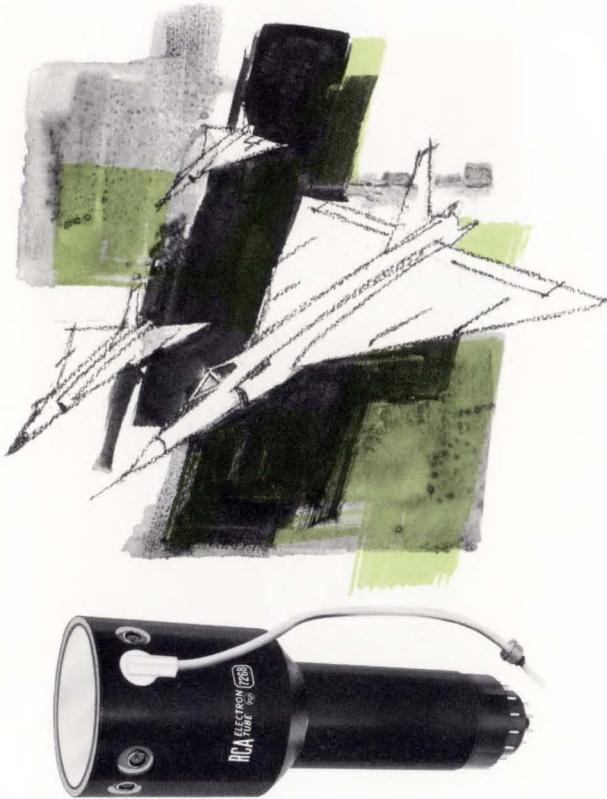
**RCA-4454**—High brightness permitting daylight viewing and an adjustable rate of information decay make the 4454 a highly recommended tube for use in commercial airborne weather radar systems. The high display uniformity of this tube results in radar signals of the same intensity being displayed at nearly the same brightness regardless of their relative position in the display. Constructional innovations which minimize manufacturing costs are combined with new methods of tube evaluation aimed at providing high-performance capability compatible with the requirements of the final system use.

Features of the 4454 include:

- High brightness for daylight viewing.
- Adjustable rate of information decay.
- High display uniformity.
- Economical construction.
- Performance tailored for airborne weather radar.
- Full 4"-diameter display.



# RCA Display-Storage Tubes



## 5"-DIAMETER DISPLAY-STORAGE TUBES

**RCA-7268**—High brightness and an adjustable rate of information decay make the 7268 highly useful for the display of information under daylight viewing conditions in airborne fire-control radar systems. This tube provides a full 4"-diameter display having excellent uniformity and positional accuracy under the severe environmental conditions encountered in airborne military equipment.

Features of the **7268** include:

- High display brightness.
- High display uniformity.
- Excellent resolution in range and azimuth.
- Two writing guns having close registration capability.
- Highly accurate display.
- Integral magnetic shield.
- Rugged internal structure.
- Integration of signals in presence of noise.



## 5"-DIAMETER DISPLAY-STORAGE TUBES

**RCA-Developmental Type C74393**—The ability to store information for many seconds and an adjustable rate of information decay make the C74393 highly suitable for use in slow-scan TV, sonar, and long-range radar applications. Among the design features which insure excellent performance capability are high brightness which permits display viewing under normal levels of room illumination, extremely high resolution to allow discrete target location (the resolution is about twice that of most display-storage tubes), high display uniformity which results in radar signals of the same intensity being displayed at nearly the same brightness regardless of their relative position in the display, high positional accuracy of displayed information, and a ruggedized tube structure.

Features of the **C74393** include:

- Resolution capability of 100 lines per inch.
- Full 4"-diameter display.
- High display uniformity.
- High display positional accuracy.
- Writing gun designed for slow speed scanning.\*
- Rugged construction.
- Integration of signals in presence of noise.

\*Scanning speed: slow—300 to 10,000 in./sec; medium—10,000 to 50,000 in./sec; fast—50,000 to 300,000 in./sec.



## other RCA Storage Tubes



### SCAN CONVERSION TUBES (GRAPHECHONS)

**RCA-7539**—A high-resolution tube employing a magnetic-deflection, electrostatic-focus type writing gun and a magnetic deflection and focus type reading gun. The 7539 is designed for use in data processing applications where signal information must be continuously transformed, with minimum loss, from one time base or scanning presentation to another. It permits the viewing on suitable TV monitors of bright displays having a continuous range of half-tone information.

Features of the **7539** include:

- Resolution capability of 150 range rings per display radius with a response of 50 per cent or better. (TV monitor systems should be designed to have a resolution of 1000 TV lines or better to fully utilize the resolution capability of 7539.)
- Simultaneous writing and reading.
- Display of stored information is adjustable from seconds to more than a minute.



### RADECHONS

**RCA-6499**—A charge-storage tube of the barrier-grid, single-beam type intended for data processing systems. The 6499 is designed to store information from microseconds to minutes and to release information at the same or different rates and is intended for digital data storage systems, time-base conversion systems, and signal delay systems.

Operational features of the **6499** include:

- Operation so that output signal is linearly related to input signal.
- Operation so that output signal is proportional to duration of input signal or signals for a given time interval.
- Operation so that output signal is proportional to the difference between two successive input signals.



# Characteristics

## RCA DISPLAY-STORAGE TUBES

| RCA TYPE      | NOMINAL DIAMETER (IN.) | MAXIMUM OVERALL LENGTH (IN.) | DEFLECTION METHOD | NO. OF WRITING GUNS | REMARKS                                                                                                                                       | INITIAL APPLICATIONS              |
|---------------|------------------------|------------------------------|-------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 4412          | 10                     | 20.75                        | E                 | 1                   | Ruggedized type with rectangular useful display area. Has integral magnetic shield.                                                           | Airborne special-purpose displays |
| (a)<br>C74371 | 10                     | 20.75                        | E                 | 1                   | Similar to 4412, but has circular useful display area and different mounting arrangement.                                                     | Surveillance Radar (PPI displays) |
| (a)<br>C74394 | 10                     | 20.75                        | E                 | 1                   | Identical to type C74371, except employs P31 phosphor screen (green fluorescence) instead of P20 phosphor screen (yellow-green fluorescence). | Surveillance radar (PPI displays) |
| (a)<br>C73983 | 7                      | 18.25                        | E                 | 1                   | Has selective erasing gun, integral magnetic shield, P4 phosphor screen (white fluorescence), and Filter-glass faceplate.                     | Sonar                             |
| (a)<br>C74321 | 7                      | 16                           | E                 | 1                   | A ruggedized type having an integral magnetic shield.                                                                                         | Airborne special-purpose displays |
| 2028          | 5                      | 15½                          | E                 | 1                   | Similar to type 6866, except has higher maximum voltage ratings.                                                                              | Airborne fire control             |
| 2053          | 5                      | 13.64                        | E                 | 1                   | A ruggedized type having an integral magnetic shield.                                                                                         | Airborne terrain-clearance radar  |
| 4454          | 5                      | 11.62                        | M                 | 1                   | Similar but not interchangeable with type 7183. Has improved contrast and display uniformity.                                                 | Airborne weather radar            |
| 6866          | 5                      | 15½                          | E                 | 1                   | One of the first display-storage tubes built in mass production.                                                                              | Airborne fire control             |
| 7183          | 5                      | 11⅝                          | M                 | 1                   | First display-storage tube used extensively in weather radar systems.                                                                         | Airborne weather radar            |
| 7268          | 5                      | 16                           | E                 | 2                   | Ruggedized type having an integral magnetic shield.                                                                                           | Airborne fire control             |
| 7315          | 5                      | 13.64                        | E                 | 1                   | Designed especially for slow-speed scanning applications.                                                                                     | Shipborne missile control         |



# **RCA DISPLAY-STORAGE TUBES**

| <b>RCA TYPE</b> | <b>NOMINAL DIAMETER (IN.)</b> | <b>MAXIMUM OVERALL LENGTH (IN.)</b> | <b>DEFLECTION METHOD</b> | <b>NO. OF WRITING GUNS</b> | <b>REMARKS</b>                                                                                                                                                                      | <b>INITIAL APPLICATIONS</b>           |
|-----------------|-------------------------------|-------------------------------------|--------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 7448            | 5                             | 13.64                               | E                        | 1                          | Identical to type 7315, except is designed for high-speed scanning applications. Is also identical to type 2053 except does not have an integral magnetic shield.                   | —                                     |
| (a)<br>C74381   | 5                             | 13.64                               | E                        | 1                          | Similar to type 7315, but has improved display uniformity and larger useful display area (4" rather than 3.8").                                                                     | Shipborne missile control             |
| (a)<br>C74393   | 5                             | 13.64                               | E                        | 1                          | A ruggedized type having an integral magnetic shield. Is mechanically similar to type 2053. Has a resolution of 100 lines/inch at a screen luminance of 100 footlam-berts.          | Sonar                                 |
| (a)<br>C74398   | 5                             | 16                                  | E                        | 2                          | A high resolution (70 lines/inch) variant of type 7268.                                                                                                                             | Airborne fire control, ground mapping |
| (a)<br>C74403   | 5                             | 13.64                               | E                        | 1                          | A ruggedized type having an integral magnetic shield. Is mechanically similar to type 2053. Has a resolution of 80 lines/inch at a screen luminance of 500 footlam-berts.           | Navigation displays                   |
| (a)<br>C74405   | 5                             | 8 $\frac{5}{8}$                     | M                        | 1                          | An experimental type designed for use where space is limited.                                                                                                                       | —                                     |
| (a)<br>C74406   | 5                             | 16                                  | E                        | 2                          | Has two writing guns, one to provide a stored signal and the other to provide a non-stored signal or to erase selectively stored information. Is mechanically similar to type 7268. | —                                     |
| (a)<br>C74410   | 5                             | 13.64                               | E                        | 1                          | The first of a factory-collimated series intended to reduce field "set-up" time. Is similar to type 2053, but provides a larger useful display area (4" rather than 3.8").          | Radar displays                        |
| (a)<br>C74367   | 3                             | 7.85                                | M                        | 1                          | A very rugged type designed for sequential writing, viewing, and erasing. Employs a P11 phosphor screen (blue fluorescence).                                                        | Special navigation systems            |



# Characteristics

## other RCA Storage Tubes

### SCAN CONVERSION TUBES (GRAPHECHONS)

| RCA TYPE | MAXIMUM DIAMETER (IN.) | MAXIMUM OVERALL LENGTH (IN.) | REMARKS                                                                                                                                                                                                                                                                                                       |
|----------|------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7539     | 3.40                   | 26                           | A charge storage tube designed for use in data processing applications where information is to be continuously transformed from one time base or scanning presentation to another. Has one electrostatic-focus, magnetic-deflection type writing gun and one magnetic-deflection, magnetic-focus reading gun. |

(a) Type numbers with prefix C are developmental types. Each of these C-numbers identifies a particular laboratory tube design but the number and the identifying data are subject to change. No obligations are assumed as to future manufacture unless otherwise arranged.

### RADECHONS

| RCA TYPE | MAXIMUM DIAMETER (IN.) | MAXIMUM OVERALL LENGTH (IN.) | REMARKS                                                                                                                                                                                                        |
|----------|------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1858     | 3.35                   | 12-7/32                      | A variant of type 6499 but designed especially for binary memory systems in computers.                                                                                                                         |
| 6499     | 3.35                   | 12-7/32                      | Barrier-grid single-beam type designed for use in digital-data storage, signal-delay, fixed signal cancellation, and in time-base conversion applications. Can store information from microseconds to minutes. |

# Display-Storage-Tube SPECIFICATIONS FORM

Your answers in the appropriate blanks on this form will assist our application engineers in recommending to you the most appropriate RCA display-storage tube for your system. If you have already prepared a detailed specification sheet listing your requirements, please send a copy to us with this form.

## SIZE OF REQUIRED DISPLAY

(Fill in appropriate information)

Diameter ..... in.  
or  
Height ..... in. by Width ..... in.

## AVAILABLE SPACE FOR TUBE

Height ..... in.  
Width ..... in.  
Depth ..... in.

## TYPE OF SERVICE

Groundbased:

Mobile ..... ☐  
Fixed ..... ☐  
Shipborne ..... ☐  
Airborne ..... ☐  
Spaceborne ..... ☐

## ENVIRONMENTAL REQUIREMENTS

(Please specify which requirements are most important and if possible specify the conditions)

Vibration .....  
Shock .....  
Altitude (Pressure) .....  
Temperature .....  
Humidity .....  
Other .....

## AMBIENT ILLUMINATION OF ENVIRONMENT IN WHICH DISPLAY IS TO BE USED

Darkened room ..... ☐  
Normally lighted room ..... ☐  
Out-of-doors ..... ☐  
Aircraft cockpit ..... ☐  
Specific luminance (brightness) required for display (if known) ..... footlamberts

## PREFERRED DEFLECTION

Electrostatic ..... ☐  
Magnetic ..... ☐

## COLOR OF DISPLAY REQUIRED

Most efficient visually ..... ☐  
Most efficient photographically ..... ☐  
Other (please specify) .....

## DISPLAY PARAMETERS

### RADAR DISPLAYS

Ranges ..... yards  
Pulse repetition frequencies  
(PRF's) ..... pps  
Azimuth rate:  
For PPI displays ..... rpm  
For sector displays ..... degrees/sec.  
For "B"-type displays ..... scans/sec.  
Total azimuth sector ..... degrees  
Range resolution required ..... yards  
Radar pulse width .....  $\mu$ sec  
Available video drive ..... volts  
Available deflection drive ..... volts  
or peak-to-peak amperes  
Peak signal-to-RMS noise .....

(Ratio applies to the weakest signals that must be detected on the display)

### TV-TYPE DISPLAYS

Frame rate ..... frames/sec  
Line rate ..... lines/sec  
Highest frequency component of  
video signal ..... cps  
Available video drive ..... volts  
Available deflection drive ..... volts  
or peak-to-peak amperes

### "A"-SCOPE DISPLAY

Fastest time base ..... sec/sweep  
Slowest time base ..... sec/sweep  
Highest frequency (Y-axis signal) ..... cps  
Is signal recurrent? ..... ☐ Yes ☐ No  
Is signal "one-shot"? ..... ☐ Yes ☐ No  
Available deflection drive ..... volts or  
peak-to-peak amperes

### OTHER DISPLAYS

If your display does not fit into any of the above categories, please give a brief description of your scanning waveform, video signal characteristics, and any additional information which has significance to your application.

.....  
.....





From:

---

---

---

Place  
Stamp  
Here

**MARKETING MANAGER**  
**STORAGE-TUBE PRODUCTS**  
**RADIO CORPORATION OF AMERICA**  
**LANCASTER, PA.**

For further information or application assistance on the storage tubes described in this booklet, please call your RCA Field Representative at our office nearest you.

#### EQUIPMENT SALES

32-36 Green Street  
Newark 2, N. J.  
(201) 485-3900

Merchandise Mart Plaza  
Rm. 1154  
Chicago 54, Ill.  
(312) 527-2900

6801 E. Washington Blvd.  
Los Angeles 22, Calif.  
(213) RAYmond 3-8361

#### GOVERNMENT SALES

415 South Fifth Street  
Harrison, New Jersey  
(201) 485-3900

224 N. Wilkinson Street  
Dayton 2, Ohio  
(513) BALdwin 6-2366

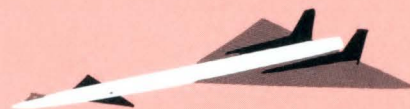
1725 K Street, N.W.  
Washington 6, D. C.  
(202) FEderal 7-8500

#### INTERDIVISIONAL SALES

32-36 Green Street  
Newark 2, N. J.  
(201) 485-3900

#### INTERNATIONAL SALES

RCA International Division  
Clark, N. J.  
(201) 382-1000



# RADIO CORPORATION OF AMERICA

ELECTRONIC COMPONENTS AND DEVICES, HARRISON, NEW JERSEY





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